Rocky Mountains | Southwest | Great Plains

Research Note RM-420

August 1982

USDA Forest Service
Rocky Mountain Forest and Range Experiment Station

Implants and Sprays for Control of Ponderosa Pine Needle Miner in Foliage of Individual Trees[1]

Robert E. Stevens[2] and David A. Leatherman[3]

Acephate implants and acephate and permethrin foliar sprays all reduced numbers of ponderosa pine needle miners to acceptable levels. Seven months after treatment, implant-treated trees averaged 3.2% needles per branch tip with living larvae versus 28.0% in untreated check trees. Foliar sprays resulted in 0% and 0.2% needles infested for permethrin and acephate, respectively, versus 5.7% in checks. Implant-treated trees also remained relatively free of infestation the second year after treatment.

Keywords: *Coleotechnites ponderosae, Pinus ponderosa,* insecticides

Management Implications

Ponderosa pine needle miners can be controlled by use of systemic insecticide implants and also through the use of foliar sprays. Best results should be obtained by timing treatments to prevent invasion of foliage by young larvae. This will vary with the year, but, in general, damage will be minimized if implants are placed about the first week in September, and foliar sprays are applied the last 2 weeks of September.

Introduction

The ponderosa pine needle miner, *Coleotechnites ponderosae* Hodges and Stevens (Lepidoptera:Gelechiidae), is a pest of ponderosa pine, *Pinus ponderosa* Dougl. ex Laws., in several Colorado Front Range localities. An infestation has persisted in Boulder County since it was first detected in 1971 (Stevens 1973, Hodges and Stevens 1978). Populations of what appear to be the same species are known also from Montana (Robinson et al. 1979)[4] and Idaho, as well as several other Colorado localities (Stevens, unpublished data).

The life history and habits of the needle miner were described by Stevens (1973). Briefly, it has a 1-year life cycle, with the moths flying and ovipositing in August and September, eggs hatching mostly in late September, and larvae overwintering. Larvae feed within the needles of the host tree. The needles fade from green to brown and drop prematurely. Needles older than the current year's growth are most often colonized by 1st instars: in heavily infested areas in Colorado in 1972, 70% of the older needles were damaged, while only 13% of the 1971 foliage was infested. Recent evaluations indicate the same general relationship of infestation rates in old versus new needles.

The insects' preference for older foliage strongly influences how much damage they cause. In general, net photosynthesis in conifers decreases with needle age after the first year (Freeland 1952). Thus, destruction of portions of older needles is of relatively less consequence to the trees' vigor than loss of new foliage would be. While no definitive studies have been con-

[1]The authors thank P. A. Farrar, J. C. Mitchell, and S. A. Mata for field and laboratory assistance. Several colleagues, including Leland Brown, Thos. W. Koerber, and Carl Crisp provided helpful suggestions. Creative Sales, Inc., Fremont, Nebr.; FMC Corporation, Philadelphia, Pa.; and Chevron Chemical Co., San Francisco, Calif., provided insecticides, and Murray Mitchell and Boulder Parks and Recreation Department gave us permission to use test sites. Their cooperation is appreciated.

[2]Entomologist, Rocky Mountain Forest and Range Experiment Station. Headquarters is in Fort Collins, in cooperation with Colorado State University.

[3]Entomologist, Colorado State Forest Service, Colorado State University, Fort Collins.

[4]Forest insect and disease conditions 1978 in the Northern Region. An unpublished report (R1 79-17) by L. A. Robinson, J. E. Dewey, and C. E. Carlson. 1979. U.S. Department of Agriculture Forest Service, P. O. Box 7669; Missoula, MT 59807.

ducted on trees sustaining long-term needle miner infestation, needle length does not seem to have been impaired, as is common with infestations of other closely related species. However, there are some indications of radial growth reduction following several years of heavy infestation (Laut et al. 1980).[5] There are no indications that damaged trees are made more vulnerable to attack by other insects, such as the mountain pine beetle, *Dendroctonus ponderosae* Hopkins.

Thus, the main effect of needle miner infestation appears to be esthetic, (i.e., trees can look more brown than green and are perceived as being unhealthy). Because the infestation extends into suburban areas, the insect is considered a pest by many, and some elect suppression.

Brown et al. (1979) reported good control of a closely related species in California, using trunk implants and foliar sprays of several insecticides. On the basis of their experiments, we chose to test a single implant technique employing acephate and foliar sprays of acephate and permethrin.

Methods and Materials

Experimental Sites

Acephate implants were evaluated on the basis of three separate experiments on a total of 33 trees on Flagstaff Mountain (Flagstaff site), in the Boulder Mountain Parks about 6 miles (10 km) west of downtown Boulder, Colo. The foliar sprays were applied to 20 trees (10 each acephate and permethrin) on private land (Mitchell site), about 6 miles (10 km) northwest of downtown Boulder. At the Flagstaff site, 12 untreated trees were used as checks for all three implant experiments. At the Mitchell site, six separate unsprayed trees were selected for use as checks for the foliar spray experiments. At both sites, the test trees were scattered over about 2.5 acres (10 ha). Trees in all instances were typical of those in ponderosa pine forests in the area, being about 6-12 inches (15-30 cm) in diameter at breast height (d.b.h.), and 30-60 feet (10-20 m) tall. All trees were subjectively selected on the basis of having an adequate foliage complement and showing visual evidence of moderate to heavy infestation during previous seasons. These criteria assured that maximum numbers of needles and insects would likely be available for testing and subsequent sampling.

Insecticide Application

Medicap implants,[6] each containing 0.03 ounce (0.8 g) of 85% technical acephate, were inserted into holes bored into test trees according to manufacturer's recommendations for number (depending on tree size) and arrangement (4-inch (10-cm) intervals in an upward spiral manner starting near the ground line) (fig. 1). For example, a 10-inch (25-cm) d.b.h. tree required eight implants.

Implants were inserted on September 5, 1979, in 12 trees (one of which was subsequently cut and lost to the experiment); on June 17, 1980, in 9 more trees; and on August 12, 1980, in 12 more trees. The first implant experiment was aimed at the 1979-1980 generation (i.e., newly established larvae that would overwinter in 1979-1980), and the second two were attempts to protect trees against the 1980-1981 generation.

Foliar sprays were applied on the morning of September 18, 1980, in an attempt to kill eggs and migrating 1st-stage larvae. Permethrin 3.2 EC was mixed to provide 2.0 ounces of active ingredient (AI) per 100 gallons water (57 g/378 l). The acephate (Orthene Tree and Ornamental Spray) was mixed to provide 8.0 ounces AI per 100 gallons water (227 g/378 l). A commercial, truck-mounted, hydraulic sprayer was used to apply the sprays to the point of runoff.

Sampling and Analysis

The sampling unit used was a branch tip, including current and one previous year's needles. Four samples were taken from each tree, one from each aspect (cardinal direction), at a height of 6-12 feet (2-4 m). Limited

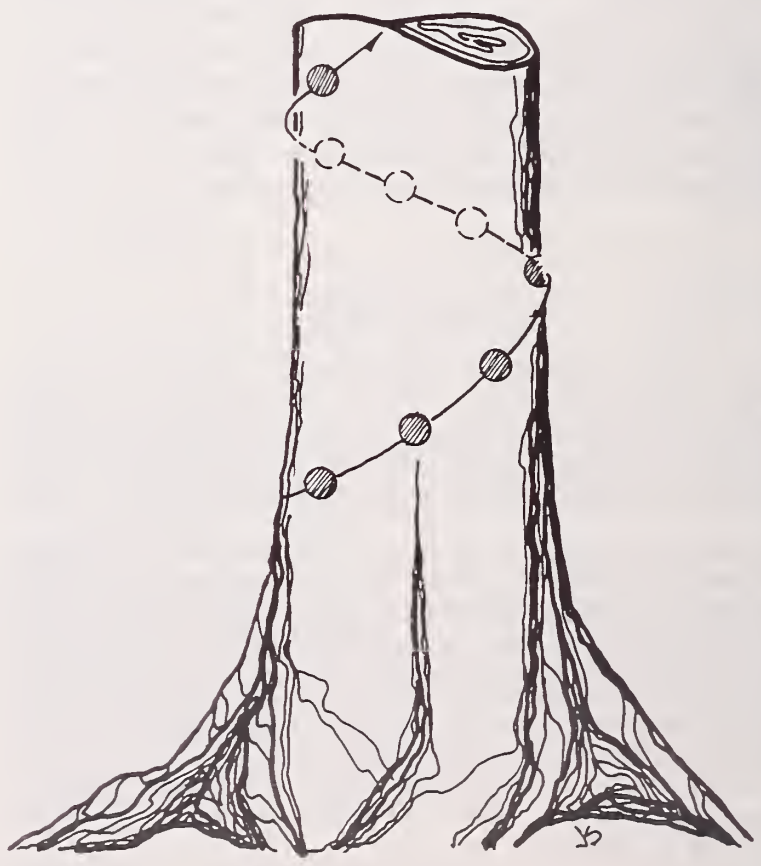

Figure 1.—Typical arrangements of implants at base of tree.

[5] *Colorado forest insect and disease conditions 1978-1979. An unpublished report by J. G. Laut, L. B. Helburg, D. A. Leatherman, M. E. Schomaker, and S. J. Kreig. 1980. Insect and Disease Division, Colorado State Forest Service, Colorado State University, Fort Collins, CO 80523.*

[6] *The use of trade and company names does not constitute an endorsement by the U.S. Department of Agriculture Forest Service to the exclusion of others that may be suitable.*

sampling (Stevens, unpublished data) has shown this crown level provides enough insects for test purposes. Sampling for insect mortality evaluation at the Flagstaff site was done November 16, 1979, April 28, 1980 (first implant experiment), and October 17, 1980 (all implant experiments). Samples from the sprayed trees were taken on October 30, 1980. All samples were stored at about 35°F (2° C) until examination for larvae by needle dissection under a standard stereoscopic microscope. No attempt was made to separate the effect of foliar sprays on eggs and migrating 1st-stage larvae.

Counts of needles and of living and dead larvae from the four branch tips from each tree were made separately but were pooled for overall analysis; mean numbers and percentages of living larvae per tip in implant-treated trees were compared to applicable check series using a *t*-test, $P = 0.05$. A separate analysis was made to determine if insect numbers varied by aspect. The data from the foliar spray test were such that no statistical analyses were needed.

Results and Discussion

All three implant treatments resulted in significant differences in numbers of living needle miner larvae compared to those in untreated checks (table 1). The treatment applied nearest the time of larval establishment (September 5) was most effective; the percentage of live larvae was just over 7% versus 56% in the check trees at about 7 months (April) after treatment. Only 3.2% of the needles were infested in treated trees versus 28.0% in the untreated checks. The mean recorded count at that time of about 6 larvae per tip was strongly influenced by 2 of the 11 sample trees on which counts were about 28 and 32 larvae per tip, respectively. And in both these cases, all the larvae came from tips from only two sides of the tree.

Foliage on trees treated September 5, 1979, was colonized in 1980 only about 10% as heavily as was that on the untreated checks (table 1). This apparent "carryover" effect of acephate implants has also been reported by other workers (Carl Crisp, personal communication, December 1980) and indicates that this treatment was effective for at least 2 years.

Visual inspection in September 1980 of the implant-caused wounds made on September 5, 1979, indicated all were healing well. In fact, some wounds were hardly visible, and no unusual resin exudations were noted.

Needle miner numbers were markedly lower at the Mitchell site (a mean of 7.7 larvae per tip in checks versus 47.1 at Flagstaff Mountain). Both foliar sprays resulted in foliage essentially free of needle miners (table 2), with 0.1% of the sprayed needles infested versus 5.7% on unsprayed check trees. It is noted (NOAA 1980) that 0.55 inches (1.4 cm) of rain fell at Boulder on September 20, 2 days after the trees were sprayed; this had no apparent adverse effect on the test. There were no indications that needle miner populations varied by aspect.

Table 2.—Effect of permethrin and acephate sprays on branch tips infested with pine needle miners, Boulder County, Colo., 1979–80

Treatment	October 30, 1980, sample		
	Needles	Living larvae	
	–number–	*–number–*	*–percent–*
Permethrin spray			
September 18, 1980	131.9 ± 57.5[a]	0	0
Acephate spray			
September 18, 1980	119.3 ± 50.4	0.2 ± 0.3	1.2 ± 2.1
Checks	134.0 ± 62.9	7.7 ± 3.6	78.0 ± 14.0

[a]*Mean and standard deviation.*

All treatments resulted in what we consider to be acceptably low numbers of insects. While needle miner numbers were greatly reduced by treatment, heavily infested trees' appearance did not dramatically improve because of mined needles retained from previous years. Not until most of these mined needles fall, and new foliage remains unattacked, will infested trees regain a healthy appearance.

Table 1.—Effect of acephate implants on branch tips infested with pine needle miners, Boulder County, Colo., 1979–80

Treatment	November 16, 1979, sample			April 28, 1980, sample			October 17, 1980, sample		
	Needles	Living larvae		Needles	Living larvae		Needles	Living larvae	
	– number –	*– number –*	*– percent –*	*– number –*	*– number –*	*– percent –*	*– number –*	*– number –*	*–percent –*
Acephate implants									
September 5, 1979	142.6 ± 52.7[a]	13.9 ± 24.0	35.5 ± 33.9	187.3 ± 67.9	5.9 ± 12.1	7.1 ± 14.6	200.6 ± 71.7	3.3 ± 4.2	20.5 ± 22.5
June 17, 1980	–	–	–	–	–	–	195.6 ± 89.0	5.9 ± 6.9	22.9 ± 19.3
August 12, 1980	–	–	–	–	–	–	187.6 ± 90.4	8.0 ± 8.5	27.6 ± 19.8
Checks	143.1 ± 57.6	54.8 ± 37.7	80.1 ± 11.2	168.3 ± 73.9	47.1 ± 30.2	56.2 ± 9.1	187.0 ± 95.7	33.8 ± 20.9	74.1 ± 12.3

[a]*Mean and standard deviation.*

Literature Cited

Brown, L. R., C. O. Eads, C. E. Crisp, and M. Page. 1979. Control of a Jeffrey pine needleminer by spraying and trunk implantations and resultant acephate residues. Journal of Economic Entomology 72:51-54.

Freeland, R. O. 1952. Effect of age of leaves upon the rate of photosynthesis in some conifers. Plant Physiology 27:685-690.

Hodges, R. W., and R. E. Stevens. 1978. Two new pine-feeding species of *Coleotechnites* (Gelechiidae). Journal of the Lepidopterists' Society 32:118-122.

National Oceanic and Atmospheric Administration. 1980. Climatological Data, Colorado; Asheville, North Carolina 85(9). 17 p.

Stevens, R. E. 1973. A ponderosa pine needle miner in the Colorado Front Range. USDA Forest Service Research Note RM-228, 4 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

Pesticide Precautionary Statement

This publication reports research involving pesticides. At the time of printing, the acephate implants were registered for use with the appropriate agencies, and registration was being sought in the case of the acephate foliar spray. Permethrin was not registered for forestry uses. Pesticides must be properly registered before they can be used. Check with local authorities and suppliers to determine current registration status and availability of these materials.

CAUTION: Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions, and heed all precautions on the labels. Store pesticides in original containers—out of reach of children and pets.

Agriculture—CSU, Fort Collins